ORAL HISTORY OF THE TENNESSEE VALLEY AUTHORITY
INTERVIEW WITH
ROBERT A. MONROE

BY - CHARLES W. CRAWFORD
TRANSCRIBER - SHARON HESSE
ORAL HISTORY RESEARCH OFFICE
MEMPHIS STATE UNIVERSITY

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ORAL HISTORY OF THE TENNESSEE VALLEY AUTHORITY

INTERVIEW WITH ROBERT A. MONROE

OCTOBER 22, 1970

BY CHARLES W. CRAWFORD

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ORAL HISTORY RESEARCH OFFICE

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PLACE Knoxville, Tenn.

DATE Oct. 22, 1970

x Robert A. Monroe
(Interviewee) Robert A. Monroe

Charles W. Crawford
(For the Mississippi Valley Archives
of the John Willard Brister Library
of Memphis State University)

(OHRO Form B)

THIS IS THE ORAL HISTORY RESEARCH OFFICE OF MEMPHIS STATE UNIVERSITY. THIS PROJECT IS "AN ORAL HISTORY OF THE TENNESSEE VALLEY AUTHORITY." THE PLACE IS KNOXVILLE, TENNESSEE. THE DATE IS OCTOBER 22, 1970, AND THE INTERVIEW IS WITH MR. R.A. MONROE, FORMERLY WITH THE TENNESSEE VALLEY AUTHORITY. THE INTERVIEW IS BY DR. CHARLES W. CRAWFORD, DIRECTOR OF THE MEMPHIS STATE UNIVERSITY ORAL HISTORY RESEARCH OFFICE, AND WAS TRANSCRIBED BY MRS. SHARON HESSE.

CRAWFORD: Mr. Monroe, we will conduct this interview as you like, but I suggest that we start by getting a summary of your early life and experience before you joined TVA. If you would start with when and where you were born and then go on with your education and experience, we'll start from there.

MONROE: I was born in Willow Ranch, California, May 13, 1889. My father was a graduate of Kalamazoo University, majored in mathematics, had been county school superintendent and high school principal in Lake County, Oregon, and ended up as a rancher. I left home at about the age of seventeen, on graduation from high school in 1908 and entered the University of California where I graduated in May 1912 with a B. S. degree in Civil Engineering. I was elected to Tau Beta Pi, Sigma Psi, and Beta Kappa.

I entered the employment of the Pacific Gas and Electric Company in San Francisco immediately on graduation and worked for that company in the civil engineering design division until the incidence of World War I. In 1916, with war threatening I obtained a Commission as First Lieutenant in the Engineer Reserve Corp and was ordered to active service in July of 1917. After a

3 months service in an engineer officer's training camp at Vancouver Barracks, Washington, I was assigned to the Fourth Engineers, Fourth Division and went overseas with that organization early in 1918. My initial commission was as first lieutenant of engineers, and I was later promoted to captain. I also passed an examination for provisional appointment in the Corps of Engineers regular army, and was considered a permanent member of the Corps of Engineers until I resigned in 1920. Our division was credited with participation in six major offensives during the war. We were in active combat most of the time until the armistice in November of 1918 and were in the army of occupation in Germany until July of 1919 when the 4th Division returned to the United States.

Immediately on returning, I resigned my commission, got married and went back to work with the Pacific Gas and Electric Company. I continued to work for this company from 1919 until 1929, during which time I was advanced to the position of Assistant Chief Civil Engineer. In 1919 a former army associate, Colonel James Groden, now with the Aluminum Company of America, contacted me and offered double my salary to accept employment with the Aluminum Company of America. After considerable hesitation I accepted the offer which involved moving my family to Pittsburg. I spent about two years with Alcoa on investigation of water power sites on most of the United States. My assignment was to report on favorable sites for development of large amounts of power where the cost could not exceed the very low figure set by the Aluminum Company.

As the 1929-34 depression deepened, it became evident that the Aluminum Company could not develop any large hydroelectric projects in the near future due to the lack of demand for aluminum and to the fact that the United States Government was beginning to control the power development on most

of the important rivers. So I was assigned to conduct an investigation of the causes and develop a cure for vibration caused by wind on overhead transmission conductors. I spent about two years on this problem, which was very serious. We developed a satisfactory vibration damper, and also a method of protection to the cable to prevent breakage from vibration. In September of 1933 I realized that I had either to find engineering employment elsewhere or become a sort of sales engineer for the Aluminum Company, which I did not care to do, so I resigned and accepted an offer from the Bureau of Reclamation as a senior engineer.

CRAWFORD: Was that 1933, sir?

MONROE: Yes, in October 1933. On arrival at Denver, Mr. John L. Savage, Chief Design Engineer of the Bureau of Reclamation after about a half-hour talk regarding the condition of the plans for the Boulder Power Plant assigned me to take charge of the Power Plant Design Division and attempt to get contract drawings, which were well behind schedule, in shape for immediate construction. I remained four years--from '33 until '37--the U.S.B.R. during which period we handled the design of Boulder Power Plant, the first stage of Grand Coulee Power Plant--several power plants; on the all American Canal, The Madden Power Plant on the Panama Canal, and Norris, Wheeler and Guntersville projects for the TVA. We also made preliminary designs for the Shasta Power Plant and for Pickwick and Chickamauga projects of TVA.

In the Fall of 1936, at the invitation of the Tennessee Valley Authority, I came to Knoxville for an interview respecting possible employment.

After a second interview, during which period I met all of the TVA directors and management officials, I came to work with TVA in March 1937 and continued until reaching the mandatory retirement of seventy in 1959.

CRAWFORD: Can you tell me something about your contact with TVA between the time you first heard of TVA and 1937?

MONROE: The U.S. Bureau of Reclamation handled the design of Norris, Wheeler, and Guntersville projects also preliminary design on Pickwick and Chickamauga projects. In addition to supervising the the power plant designs the TVA project engineers on the job and made several trips to the Tennessee Valley to observe and give advice on construction features. The reason for my initially being asked to come to work for TVA was that Mr. Savage, who was chief Consulting Engineer for the Authority, recommended that I be employed to succeed Byron Steel who had resigned as Chief Design Engineer of TVA because of some disagreement with Mr. Carl Bock on design problems of Chickamauga Dam. But by the time I had actually entered employment of TVA, contact had been made with Mr. Hagaman formerly of Stone and Webster, who had been employed for the job; and I arrived at Knoxville with no particular assignment. Because of my experience on hydroelectric investigation, I was assigned to the Water Control Planning Division under direction of Sherman Woodward as Head Planning Engineer.

CRAWFORD: Who did you work under at that time? Sherman Woodward?

MONROE: Yes. I was later promoted to Assistant Chief of that Department. In this capacity I had supervision of the project Planning Division,

which was headed by Mr. James Bowman; the Maps and Survey Division, which was headed by Nelsayford and the Power Division, which was under Mr. Dean Wood. In 1941, when Colonel Parker was promoted to Chief Engineer, replacing Mr. Carl Bock, I was transferred to the chief engineer's office as Assistant to the Chief Engineer, with particular assignment to follow the procurement of materials for construction of the hydroelectric and steam plants which were being rushed to completion for the war effort. On Colonel Parker's resignation as Chief Engineer, Mr. C. E. Blee was appointed as Chief Engineer, and my assignment was changed to that of Assistant Chief Engineer.

CRAWFORD: Do you remember what year that was, sir?

MONROE: It was June 1943.

CRAWFORD: And Colonel Parker went to MIT then, didn't he?

MONROE: Yes, as head of the Civil Engineering Department of MIT. He soon after joined the Boston firm of Charles T. Main. After 1945 engineering activities were at a very low ebb. The TVA Chief Design Engineer, George Rich, resigned to join the consulting firm of Charles T. Main, and Mr. Blee gave me the option of taking over the duties of the Chief Design Engineer, which I gladly accepted. This job afforded me much greater independence and responsibility and, to my mind, was a most desirable position.

CRAWFORD: What size was the design division at that time?

MONROE: At the time I assumed control the Division numbered around 600

including engineers, and technicians, and secretaries. Around 1950 the number increased rapidly to about 850, and remained at about that level after that.

CRAWFORD: Did you have difficulty getting enough space for all these people to work?

MONROE: We occupied every square foot of available space except the lavatories. We had people scattered in all around the Knoxville complex, including the New Sprankle Building, the Union Building, the Daylight Building, and the Empire Building. We had people working in areas where there was only seven feet head room and no ventilation, which we did our best to correct.

CRAWFORD: I suppose that you saw the need for a new building at that time, didn't you?

MONROE: Yes indeed; our architectural designers of whom I had general supervision, made numerous studies and suggestions for improvement of existing space or for a new building, but none got beyond the planning stage.

CRAWFORD: Did you have a steady increase in your work load during this time?

MONROE: Yes. We were always endeavoring to hire more engineers. It became very hectic after the start of the Korean War and the rapid build-up of the electric load on the TVA system. We would hardly get well started on the design of a new major steam plant when another would be authorized.

The only thing that saved our Design Division from being a bottleneck on the construction was inability of manufacturers to supply major equipment on schedule, and their delay gave us time to get the necessary construction drawings out. A large steam plant requires in the order of 10,000 design drawings by TVA in addition to probably double that number furnished by the equipment manufacturers. Considering an average about one finished drawing per man per month, one can visualize how the addition of a power plant every second year crowded us.

CRAWFORD: Did the work get simpler as you went along? Were you able to use what you learned in one power plant in the production or design of another?

MONROE: Oh, very greatly so. I doubt when we built our first steam power plant at Watts Bar in 1940-42 if there were half a dozen men in the design force who had close familiarity with the requirements of a major steam plant, but with the invaluable assistance of the manufacturers, on whom we depended greatly, a very succesful plant was designed and constructed beginning with Johnsonville 1949-51, TVA constructed 8 major steam plants aggreating over 13 million kilowats capacity, by the time I retired in 1959 TVA was certainly one of the leaders in the development of the high pressure, high temperature steam plants in the United States during this period.

CRAWFORD: You were building more steam plants, I believe, at that time than anyone in the United States, weren't you?

MONROE: Yes. The only close competitor might have been the American Gas

and Electric Company. Philip Sporn, later President and at that time Chief Engineer of the American Gas and Electric, although he did not like TVA, cheerfully admitted that we were doing very excellent work. I once heard a comment by an engineer that TVA only followed on design of steam plants, but was never a leader. This comment was made by an engineer who had at one time been involved in the design of some earlier low pressure steam plants, and to my mind it was only a matter of sour grapes.

CRAWFORD: Well, you were producing more of them; you were designing more of them than anyone else at that time.

MONROE: I think also we were advancing the art. We were going to larger sixes, higher pressures, higher temperatures, to reheat and to other major improvements in advance, I think, of any of the other companies in the United States except that American Gas and Electric pretty well kept pace with us.

CRAWFORD: But they built fewer plants, didn't they?

MONROE: They did.

CRAWFORD: Did you attempt to make changes as you went along? Did you try to add all the progressive developments you could to each new design?

MONROE: Definitely yes. The urge to build larger and more economic plants came both from our operating department and from the manufacturers.

We kept a very close check on what was being built elsewhere and what on the manufacturers said they could furnish, and we frequently even crowded the manufacturers up a little on their proposals.

CRAWFORD: What companies did you work with most importantly in this time?

MONROE: On Turbines and generators with General Electric, and Westinghouse, and to a limited extent with Allis-Chalmers; on boilers with Combustion, Engineering and Babcock and Wilcox. Purchases of other facilities such as boiler feed pumps, condensers, transformers, and so on were scattered among most of the major manufacturers. Toward the latter part of my period of activity we made contact with foreign companies, and about the time I retired we had entered into contracts for generators and turbines from foreign manufacturers, who quoted lower prices even though they were subjected to a heavy import duty.

CRAWFORD: Why were you turning to foreign suppliers? Was it because of lower prices?

MONROE: Yes. TVA felt, . . . in fact, it was proven that there was an agreement between the American manufacturers on prices to be bid and decisions been made by them as to who would bet the TVA business on various contacts. Also the foreign manufacturers bids came in so far under those of the American companies that we felt constrained to give the business to them.

CRAWFORD: Did this have any effect in changing domestic prices?. Were they

lowered to meet the competition?

MONROE: Yes. I'm sure that that was a factor. Also I think the antitrust action of the United States Government against these people resulted in their lowering their prices. TVA, received a substantial refund on contracts for several major items of equipment they had furnished.

CRAWFORD: What design work did you do during this period other than steam plant work, Mr. Monroe?

MONROE: All of the hydroelectric developments on the main river were made during my period of activity with TVA. First, as I said, the design of several of the earlier projects was handled in Denver while I was with the USBR. Later on as TVA's Chief Design Engineer I had direct supervision of the design of all of the main river projects and of all other items such as buildings, substations, chemical facilities etc. The Division of Power handled design of transmission lines and distribution facilities.

CRAWFORD: Did your experience with the Bureau of Reclamation help you at that time?

MONROE: Yes. Also I previously had nearly 20 years experience with Pacific Gas and Electric Co. on hydroelectric and steam plant power design. The California hydroplants were mostly high-head with moderate flow of water. The TVA projects have large flows and lower heads. Until I came with the Aluminum Company of America, I had had very little experience on lower head plants.

The projects at the Bureau was varied. The head at Boulder was over 600 feet; Grand Coulee around 500, and the others were lower. All of this experience helped.

CRAWFORD: I'm sure that it did. What was the last dam you worked on for TVA?

MONROE: It was the Patrick Henry project on the South fork of the Holston. This was the last major hydro project completed for a number of years. Construction has recently been started on the Fort Loudon extension, and the Elk river project near Wheeler. Those are the only hydroprojects that are being built since I retired.

CRAWFORD: When did you develop the feeling--or did you-- that practically all the dams had been built that could be built in the Tennessee River Valley?

MONROE: Well, I knew so from the #308 reports previously made by the Corps of Engineers, and from TVA investigations made during the period I was in the Water Control Planning Department. We made a comprehensive report which partically paralleled, but gave greater detail, than the Army Engineer's #308 report made in 1930. There is no question that with the river canalized from the major headwaters to the mouth, the major hydroelectric potential is completely developed.

CRAWFORD: When did you start your planning for steam plants? Did that take place before you were in design?

MONROE: To a limited extent. I was one of the first TVA advocates of building steam plants long before I went into design. I was vigorously in favor of building steam plants from the incidence of the hydroelectric projects. I maintained--and I'm sure I was right--that the steam plants would make the flood-control facilities more effective, and were a necessary feature of an economic river development. Furthermore, I argued that the steam plants could produce power, at the then cost of coat and equipment at a lower price than power from the main river projects. I never could agree that a dollar's worth of flood control was worth more than a dollar's worth of power. And if you followed that conclusion I think you would operate the reservoirs to store water to a somewhat higher level than are presently established.

CRAWFORD: But have more water for power?

MONROE: And have more water for power. But that involves a sort of ideological argument somewhat like the proposition whether it is economic to dig up valuable orchards by hydraulic dredges to mine the gold underneath and leave the area a waste of cobbles. In California the mining companies could afford to pay exhorbitant prices for the orchards and ruin them, but I doubt if it was economic for the country to lay waste to many thousands of acres of good orchard land.

CRAWFORD: Were you anticipating future power needs in the area? Did you foresee that there would not be enough?

MONROE: Yes. The Water Control Planning Division made estimates of the

future increase in power that might be experienced. As a matter of fact, I made estimates of growth for the Pacific Gas and Electric Company as far back as 1913--which would be fifty-seven years ago. We projected an increase of 7 1/2 percent compounded annually. Today that stands as very close approximation of the actual growth.

CRAWFORD: How was your report received at the time? Did people think it was too optimistic?

MONROE: Yes, very much so. But the growth here has been considerably higher, more nearly in the order, of 10 percent annually over the earlier years, although it is now decreasing. And I think in all such estimates the assumption should be made that finally the growth of power will parallel, but be a little bit greater than the growth of population. But in the interim the growth will be more rapid. A very interesting example of that: I was a member of the commission sent to the World Bank to make a study of the power resources of the Cauca Valley in Colombia.

CRAWFORD: Was that after your retirement, sir?

MONROE: No, I was loaned to the World Bank for that purpose. I spent about four months in the area, and wrote the power part of the report. California, a city of over 1 million in the Cauca Valley was in great need of more power. I made an estimate of the growth of power that would be experienced if the power were available but the World Bank management considered my estimate too high. Since then the demand has increased so rapidly that the

additional plants which have been constructed are over loaded.

CRAWFORD: Your guess was correct then?

MONROE: My guess was correct. It wasn't a guess; it was a prediction based on facts and experience.

CRAWFORD: Were your estimates of population growth for this area correct?

MONROE: I don't know. We had available the estimates made by a TVA division that closely follows the growth statistics of Tennessee, and we used that. I don't know how their predictions have worked out. We did not follow the estimated growth of population in estimating our growth of power. We projected the statistics for the growth of power in the TVA area over the past ten or fifteen years for which we had such information.

CRAWFORD: Were you looking ahead to the production of nuclear plants?

MONROE: No, in fact it was a general conclusion of the engineering fraternity, even at the time when I retired, that the development of nuclear plants was still perhaps 10 years distant. It was going to be feasible, but equipment was not yet available. TVA had no plans for immediate construction of plants when I left in 1959. We did have a group of engineers working with AEC at Oak Ridge on design of a gas cooled nuclear reactor which was finally abandoned.

CRAWFORD: Have you kept up with it since? Do you know when this decision

was made to change to nuclear plants?

MONROE: I was not involved in that decision. Construction of the Browns Ferry Plant, which is the first TVA nuclear plant, was begun in Dec. 1966 and the first unit was scheduled for operation in 1971. It has been under construction for about four years now and the project is behind schedule.

CRAWFORD: I believe there have been some manufacturer delays of supplies and so forth.

MONROE: The manufacturer's delay has resulted in a delay of the operating date. Under the present conditions of growth and load and of shortage of coal, the power is sorely needed; and TVA will make every effort to complete that plant and get it on the line at the earliest possible date. Mr. Palo will be able to give you much better information on that question since it's all developed since I retired.

CRAWFORD: Where did you turn for your plans for steam plants? What did you know about it at the time? Had you any experience before coming to TVA?

MONROE: Yes. The Pacific Gas and Electric Company had developed several rather important steam plants, but they were low temperature and low pressure and didn't constitute much of a precedent for a modern design. TVA had a preliminary experience on the Watts Bar Steam Plant where we installed 240,000 kilowatts consisting of four 60,000 kilowatt units. This plant was

constructed during 1940-45 with the first unit operating in 1942. This gave us an initial experience in the design of all the features of a modern steam plant. For design of the plant TVA was fortunate in having a very capable Mechanical Design Engineer, Mr. H. J. Peterson, and several very competent assistants who were quite familiar with steam plant design, and we designed the plant with the aid of the manufacturers. So far as I know, no major errors were made in any of TVA's steam plants.

CRAWFORD: Did you start that one with the idea of using it to experiment with higher pressures and temperatures?

MONROE: No. At that time, 1946, Watts Bar utilized the upper limits of temperature and pressure for which equipment could be obtained.

CRAWFORD: Did you have ideas about increasing those upper limits when you started Watts Bar?

MONROE: Not particularly. At the time it was comparable with the most efficient plants being constructed by the most progressive utilities. We studied the records of the Federal Power Commission on the design, cost of construction, and efficiency of all the major plants in the United States. Mr. Chambers, a mechanical engineer by profession and a very capable man, was assigned to go to Washington at frequent intervals and obtain records of the cost of construction and operation including type of steam plant, temperature, pressure, and operating efficiency of all the major operating utilities in the United States, and we kept a file of all that information.

We obviously could not supply equipment, but after we started to build plants, we consistently kept pace or were even a little ahead of what was being built elsewhere.

CRAWFORD: When did you start that practice of securing this information from the Federal Power Commission?

MONROE: About 1950, possibly a little before. I suspect the record is still somewhere in the Design Division Files.

CRAWFORD: Did you forsee any problems in the supply of coal at that time?

MONROE: Not at all. The reports of the geologists, and of the coal suppliers as to the amount of coal that was available in the Cumberland and southern areas gave assurance that the supply was more than adequate for many years to come. Obviously the coal is still available if the miners will get it out of the ground.

CRAWFORD: Yes, I believe the geologists were correct in that--that the coal was there.

MONROE: And it still is--most of it. TVA's practices in buying coal have been severly criticized by the coal suppliers as not giving them enough money to install the equipment that is necessary to mine coal safely. The practice of buying spot coal, which is in a way distressed coal, wherever available has been criticized. But the TVA power division endeavors to purchase its coal at the lowest possible price for production of low cost electricity.

CRAWFORD: They are, in fact, required to that, I believe.

MONROE: Yes, they are required to do that, I believe. The procurement of the coal was never the responsibility of the Design division, but we did know the price of fuel and made our calculations on the cost of power on the basis of the going price of coal without increasing it, as perhaps careful foresight might have dictated. You realize by the time I left, this inflation cycle was just getting under way.

CRAWFORD: Prices were fairly stable during the time you were there, I believe?

MONROE: Yes, although the trend was upward.

CRAWFORD: Than they were later, at any rate.

MONROE: The rise in prices had been gradual. There had been some increase; but the actual inflation mostly developed during the sixties. I'm sure it did on salaries.

CRAWFORD: Yes, there's been tremendous inflation during the last decade--more than, I believe, the time that you were there, certainly. Well, what about the personnel in design department? Did you recruit engineers yourself, or did you interview new employees?

MONROE: We had a rather fixed policy of promoting from within the organination and hiring new employees in the lower grades. The actual interviewing and selection of new employees was generally made by Mr. B. Erskine,

the personnel man in my division. Have you had any opportunity to talk to him?

CRAWFORD: No, sir, I have not. Is he still with TVA, or has he left?

MONROE: He is still with TVA.

CRAWFORD: Normally I would wait until he retired before talking with him.

MONROE: Oh, I see. Incidentally he was recently elected a member of the Knoxville City school board after a very hectic series of sessions to fill a vacancy. Every spring, he visited the major Eastern Universities on a recruiting trip. In the early days of TVA offers of employment to graduating seniors were made only to men whose grades ranked in the upper half, or preferably the upper third of their class. Later we got to the point where any engineering graduate with a passing record was considered aceptable. We empolyed some students who worked half time and went back to school for half the time, and got a few employees that way. They generally came back to work with us after they graduated, but not always. Most of our older employees, had had years of experience elsewhere stayed with us and were capable, were promoted without going outside to hire new people. This policy has been very successful.

CRAWFORD: At what universities and in what areas did you recruit most of your engineers?

MONROE: The eastern United States. I suppose we got more engineering

graduates from the University of Tennessee than from any of the others, although we obtained men from Georgia Tech, Auburn,MIT, Penn State, Illinois, Wisconsin, Iowa in fact all of the major universities in the East and occasionally from California and Stanford. I understand TVA is currently in need of more civil engineers. During my time there was no particular shortage of civil engineers but always need for mechanical electrical, and nuclear graduates. Now, the tide has turned, it is difficult to hire good, capable civil engineers.

CRAWFORD: But that is a change.

MONROE: Yes, TVA is actively trying to recruit civil engineers at the present time.

CRAWFORD: Were you able to design things very much as you wished? Did you have to consult with other divisions at TVA?

MONROE: We worked closely with the Division of Power in connection with the design of our hydroelectric and steam power plants. The Power Division always sent operating personnel to each project when installation of equipment was started. New plant design drawings were furnished to power for review. We had to work very closely with the Construction Division, in order to meet job requirements for drawings and in the procurement of materials. We also worked very closely with the Procurement Division and we made the initial recommendations for purchase of equipment. And as I remember, the Chief Engineer made the recommendation on purchases up to $500,000; above $500,000, Board

approval was required.

CRAWFORD: I know they did have an upper limit.

MONROE: We worked also closely with the Department of Health and Safety, necessarily because they were always following our design work to make certain that it met safety requirements. Sometimes we had long arguments with them--very friendly however.

CRAWFORD: Did you have the support of the board in all of your design undertaking?

MONROE: Yes; the board very seldom questioned the design. Initially a Planning Report prepared by Water Control Planning with some assistance from Design is approved by the Board. This report is followed fairly closely by Design. Arguments over changes sometimes develop. The Planning report might show the power plant on one side of the river, and after making a detailed study Design might find it better to locate it on the other side. Such changes in the Planning report were always resolved before the construction drawings were started. Problems of this sort also frequently arose with the Power Department. The height of stacks for steam plants was often open to question. The Design Division, usually called for higher stacks than the Department of Power wanted because of the added expense, which is included in power capital cost. TVA is now installing precipitatiors in all those stacks and also building much higher stacks in newer plants.

CRAWFORD: There is a great deal of concern with that sort of thing now.

MONROE: When I left here there was quite a question as to what should be done at Kingston Power Plant; whether to raise the stacks or put in precipitators. I was rather favorable to raising the stacks, and maybe putting in the precipitators as well. They have since installed precipitators at Kingston.

CRAWFORD: Yes, I believe that's the trend at this time.

MONROE: Currently stacks are being built very much higher. Initially stacks were about 300 feet high. Now, they're going up to 1,000 feet.

CRAWFORD: That's quite a change.

MONROE: That's a tremendous change. The higher stacks discharge the dust and the sulphur dioxide gas over a very much wider area. The stack diameter decreases as elevation increases which creates a higher exit velocity. By this means the sulphur fumes are disbursed and prevented from descending on the surrounding country and damaging the vegetation. Also the small amount of fly ash not caught by precipitators is scattered over a wide area and becomes less noticeable.

CRAWFORD: How effective are the precipitators?

MONROE: I think they're guaranteed to remove 95% of the ash. It is reported that some of the precipitators have not quite met the guarantee, but they can approximate that.

CRAWFORD: Well, things have changed a good deal in design engineering since that time.

MONROE: Very much so.

CRAWFORD: Can you tell me something, since I'll be meeting with him this afternoon, about Mr. Palo's work in connection with you, Mr. Monroe, and TVA?

MONROE: Before I took charge of the Design Division, if I remember correctly, Mr. Palo was the Assistant Head of the Civil Engineering Design Division, reporting to Mr. Adolph Meyer. He went into World War II voluntarily, serving in the Navy. When he returned I had to find suitable employment for him,Mr. Frank Roberts, Head of Structural Steel Design had recently resigned and Mr. Palo was assigned to that position. Some years later, about 1955, Mr. Meyer resigned to enter consulting practice, leaving the position of Chief of the Civil Engineering Division vacant. I recommended to Personnel that Mr. Palo be given that assignment, and they concurred. His appointment to this position was quite a disappointment of at least three individuals who were heading branches of the Civil Engineering Division and who felt that one of them should be entitled to the job.

CRAWFORD: You attempted to make these promotions on the basis of merit, not position.

MONROE: Yes, on the basis of ability to handle the job. To my mind Mr. Palo had much the better general experience, and I think he had

that mental superiority which goes with ability. I considered him decidedly the best appointment for that job, and personnel agreed with me. The Chief Engineer also agreed with my recommendation without question.

That was about 1955. In 1958 I was advised by personnel that retirement in TVA was mandatory at age 70, which for me was 1959. I was requested to make a recommendation for a successor. I did not have responsibility for making the actual appointment. I promptly asked for Mr. Palo and the assignment was made that he would succeed to the job of chief Design Engineer on my retirement. He was assigned to my division about the middle of 1958. Soon afterward the Personnel Division decided to send him to a management school in Washington, where he spent several months on being instructed on duties of management official.

CRAWFORD: Was that a government school--government seminar in Washington?

MONROE: Not a government seminar. It was a private seminar, and he can tell you what was it. I'm not sure of the exact name, but I know it is one of the best of such schools. TVA paid a substantial fee and his expenses. He returned after the assigned period to my division, but about that time the World Engineering Society on high dams, was meeting in the U. S. The main feature of their meeting field inspection of certain TVA projects. Mr. George Leonard, our Chief Engineer, didn't have the time nor inclination to spend much of his time on that, so he practically turned the details of handling the necessary arrangements over to Mr. Palo, which took most of the time that was remaining for Mr. Palo to be in my office. In the meantime the Board had

to succed Mr. Leonard, who was due to retire about two months after me, so I had to find another man to succeed me. I recommended Mr. Walter Emmons, who was appointed and capably served as Chief Design Engineer for a period of five or six years, until he resigned a little ahead of normal retirement age.

CRAWFORD: Who were some of the most effective engineers you've worked with in TVA? I know that to be complete would have to be a long list, but perhaps you could name a few.

MONROE: It would have to be a long list. The following members of the Design Division were all competent and devoted to their work and to TVA. Mr. Palo; Mr. Emmons, who succeeded me; Mr. Walter Matthews, who had handled mechanical design of heavy gates and values; Mr. Ernie Titus in charge of structural steel design; Mr. Warren Boop, who was my assistant for a number of years and later was promoted to head of the Civil Engineering Design Branch; Mr. Svend Kvaven, Head Electrical Design Branch; Mr. Harry Tour, Head Architectural Design Branch. Mr. P. J. Freeman, Head Testing and Inspection Branch; and Mr. G. I. Teasley, who succeeded Mr. Freeman; Mr. H. J. Peterson, Head Mechanical Design Branch and his assistant Mr. Mike Gardner, who later became Assistant Chief Design Engineer. Also I should mention Raymond Hopkins who was an expert on electrical problems, and Ross Riegel who was an authority on design of dams.

CRAWFORD: You've had quite a number of able engineers on your staff.

MONROE: Yes.

CRAWFORD: Before you left TVA there was a time when you were considered as a member of the TVA Board of Directors, Mr. Monroe. Do you care to say anything about the details of that?

MONROE: General Vogel one day called my office and asked me to come to his office and asked if I would be willing to consider the job as a TVA Director. I told him that I did not think it would be a very suitable job for me because of two things. One, I was well past sixty-five, at the time, and second, because I felt that such an appointment from an intermediate management position would not be too happy from the standpoint of my associates. He also had in mind one TVA attorney whom he would like to retire and wanted to know if I would back him up on that, and I told him, "no," although I knew why he wanted to make that change. However, he did suggest my appointment as a TVA Director Sherman Adams President Eisenhower's Chief Assistant, and Adams rather promptly turned him down on the basis that I was too old--would reach retirement age too soon for that job. Later with Adams to have me appointed as a fill in until the time for appointment of a new director, with the same result--no soap.

CRAWFORD: At the time there were only two directors, I believe.

MONROE: That was during the time there were only two directors. Dr. Paty had died while in office. And the second time he made suggestion he was having difficulty with a divided board on many questions, and he felt that I would be competent.

CRAWFORD: Had you known General Vogel when you were in the Corps of

Engineers briefly in World War I?

MONROE: No. He was a good many years younger than I was and was probably still a West Point Cadet.

CRAWFORD: As a matter of fact, I believe that he didn't receive his commission until in the twenties. I've forgotten the date, but I believe he was in Michigan or in cadet service in the First World War.

MONROE: Yes, I believe he was. After graduation from West Point Gen. Vogel recieved a master's degree in engineering from the University of California, and Charles Derleth Jr. the then Dean of Engineering mentioned me as having graduated with a fine record. Also Lieutenant General Wheeler had spoken to him about my having a very satisfactory record in World War I with the Fourth Engineers, which Colonel Wheeler commanded. I resigned from the Corps of Engineers, because there were so many West Point graduates younger than I who had been activated and assigned to active service in World War I that I felt that I sould never get past the rate of major. Actually after the war all those 3 year cadets were sent back to West Point, and I would have received a fairly satisfactory file number if I'd stayed in the service. Furthermore my wife didn't care for army life.

CRAWFORD: Well, it is difficult, of course, to do that without a West Point degree.

MONROE: Actually I was on a par with the West Point graduates by having

entered the service through provisional appointment. The examination for appointment to the Corps was quite difficult and only 60 passed out of 2000 applicants. Also I had an excellent record for combat service in the war.

CRAWFORD: Well, you have not regretted your change, have you--your service with TVA?

MONROE: No. However, I think I regret the change when I left the Pacific Coast to go to Pittsburg with Alcoa. I would have advanced in due course in the organization back there and would later have received a much more substantial salary than I ever received here in TVA.

CRAWFORD: Yes, of course, this being government service, the salary was affected.

MONROE: Incidentally, I turned down many offers of better paying jobs, both while with TVA, and after retirement. I did serve as a consultant on a number of projects over a period of eight years after I retired.

CRAWFORD: I'm sure you have.

MONROE: One attractive offer was when Mr. Blee asked if I would like to go to India to supervise a study of hydroelectric possibilities on the Ganges and Indus rivers. I turned that down since I didn't care to go to India. Mr. Willaim Voorduin of the TVA Water Control Division accepted

the offer and after 5 years in India entered private employment.

CRAWFORD: Yes. Well, are there any parts of the record that we have failed to touch that you feel we should include?

MONROE: No. I think we've covered it. There was one of the TVA's activities that I was quite active in while in the Water Control Planning Department. Mr. Woodward was a member of the committee appointed to study the allocation of reservoir, flood control, and power costs to the capital accounts. Since he didn't care for that sort of work he designated me to attend practically all of the meetings of the Allocation Committee for a number of years. I am sure that I had some influence in determining the basis for the allocation of flood control, navigation and power cost by the formula which was adopted by TVA and which had, I believe, received acceptance by even the utilities as being reasonable.

CRAWFORD: That formula, of course, has been followed since.

MONROE: Yes, and it has been well accepted outside. I understand that the Department of the Interior, Federal Power Commission, and the Army engineers are all following substantially the same method.

CRAWFORD: Well, that's been quite an acceptance.

MONROE: It has.

CRAWFORD: Thank you very much, Mr. Monroe, for the memoirs.

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